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WIND TUNNEL MAGNETIC SUSPENSION AND BALANCE SYSTEMS

By

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Introduction

This report will briefly review progress during the period 5/16/90 thru 11/15/90 on the Grant NAG-1-1142. Progress has been limited, partly due to lengthy installation of new equipment on the 13 inch MSBS and partly due unforeseen commitments with a Magnetic Suspension Workshop.

Status of 13 inch MSBS

The 13 inch MSBS is now operational, following completion of the installation of the revised (4096 element) optical sensors in the vertical channels. Installation was completed roughly on schedule but testing and recommissioning was delayed owing to the Principal Investigator's involvement with a Magnetic Suspension Workshop, detailed later. Preliminary tests of the updated optical components indicate no significant problems with the new electronics. However, several mechanical shortcomings in the optical rail assemblies have been noticed. With the cooperation of the Instrument Research Division, these can be overcome with straightforward modifications. Control software has been temporarily revised to permit operation with the controller's vertical channels only seeking the lower optical edge of the model, as per traditional practice. A more complete and versatile set of revisions are in preparation and will be fully reported at the end of this Grant period. In addition, it has been realised that the control panel position display meters must now be driven directly from the controller, since no sensible signal exists at the optical system electronics. This modification will also be undertaken during this Grant period.

Work has started with the aim of preparing a modified test section assembly. The longer vertical arrays necessitate larger windows than previously used. It is realised that serious wind tunnel testing cannot be undertaken until a revised test section is ready. Consequently, the option of modifying one of the older test sections is being explored. In either case, modified (more compact) "model grabbers" are required and will be designed.

Aerodynamic Testing

It appears unlikely that much serious testing can be undertaken in this Grant period, due to the hardware problems noted above. However, work is underway to define and prepare models. As stated in the original Proposal, it is intended to carry out sting interference evaluations on a commercial transport fuselage geometry. It has been determined that a wide range of commercial transports are suitable and a search for an accurate commercially available original at the appropriate scale is underway. By way of example, a Boeing 767-200 or -300 at around 1:200 scale would be suitable and very similar in size to the slanted-base ogive-cylinder models tested previously with the 13 inch MSBS.

Technology Development

Some work is underway, though at a low level, with the intention of developing more versatile, general purpose magnetic suspension system control software. Such software would be written in a higher level language, such as "C". It is hoped than some progress can be reported by the end of this Grant period. A future decision to implement such software would necessitate a substantial upgrade of the computer power at the 13 inch MSBS.

In connection with a separate magnetic suspension project, Copley Controls transistor switching power supplies are being evaluated. There are two models available with the required voltage and current ratings for the 13 inch MSBS. Tests of (smaller) units for the magnetic levitation system will be briefly reported and a recommendation made.

Design Studies of Large Scale MSBSs

There has been no significant progress in this area.

Magnetic Suspension Workshop

The Spacecraft Controls Branch, Flight Mechanics Division, instigated and organised a Workshop on Aerospace Applications of Magnetic Suspension, held at Langley Research Center, during September 1990. One of the eleven technical sessions was on the subject of Wind Tunnel Magnetic Suspension Systems. The Principal Investigator acted as Technical Program Chairman, supported from other sources. Although not specifically cited as an activity under this Grant, it is felt that such activities are complementary and appropriate.

An International Symposium is being planned for 1991, to be held at Langley in August.

Publications

There have been no new publications directly relating to this Grant. One publication is in preparation, detailing the experiences previously acquired with base pressure telemetry from magnetically suspended wind tunnel models.